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IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his)
capacity as ATTORNEY GENERAL)
OF THE STATE OF OKLAHOMA and)
OKLAHOMA SECRETARY OF THE)
ENVIRONMENT C. MILES TOLBERT,))
in his capacity as the)
TRUSTEE FOR NATURAL RESOURCES))
FOR THE STATE OF OKLAHOMA,)
)
Plaintiff,)
)
vs.) 4:05-CV-00329-TCK-SAJ
)
TYSON FOODS, INC., et al,)
)
Defendants.)

- - - - -
THE VIDEOTAPED DEPOSITION OF
VALERIE HARDWOOD, PhD, produced as a witness on
behalf of the Defendants in the above styled and
numbered cause, taken on the 18th day of July, 2008,
in the City of Tulsa, County of Tulsa, State of
Oklahoma, before me, Lisa A. Steinmeyer, a Certified
Shorthand Reporter, duly certified under and by
virtue of the laws of the State of Oklahoma.

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I N D E X

W I T N E S S

P A G E

VALERIE HARWOOD

Direct Examination by Mr. Todd 4

Direct Examination by Ms. Longwell 160

Signature Page 171

Reporter's Certificate 172

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09:10AM

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1 Brevibacteria avium?

2 A No.

3 Q And if you haven't cultured, I assume you also
4 have not studied its fate and transport
5 characteristics?

09:10AM

6 A That's correct.

7 Q Now, what you refer to as the marker, the
8 biomarker in your term, what you're actually
9 referring to is actually the DNA sequence that's
10 contained by the Brevibacterium; is that correct?

09:10AM

11 A That is correct. We're referring to the DNA
12 sequence, yes.

13 Q Okay. For clarity, I'm going to attempt to be
14 consistent referring to the Brevibacterium as the
15 PCR Brevibacterium and the sequence as the PCR
16 sequence. Will those terms make sense to you? I
17 just want to distinguish the two.

09:10AM

18 A Well, it's really a DNA sequence, so I
19 guess --

20 Q We can call it the DNA sequence.

09:11AM

21 A DNA sequence.

22 Q If I refer to that, then we're talking about
23 what you would refer to as the biomarker?

24 A Yes.

25 Q Now, we previously discussed or at your last

09:11AM

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1 deposition you discussed that when a bacteria dies,
2 its DNA remains in the environment for some period
3 of time after that. Do you recall that?

4 A Yes, it can remain for some period of time.

5 Q Do you know how long the DNA sequence at issue 09:11AM
6 in this case can remain in nature apart from the
7 Brevibacterium that carries it?

8 A Typically in nature, bacterial DNA is rapidly
9 degraded within -- and it depends on the
10 environment, but within a matter of hours to several 09:11AM
11 days.

12 Q Okay. You said it depends on the environment.

13 A Correct.

14 Q What kind of characteristics affect how
15 quickly the DNA degrades? 09:11AM

16 A Characteristics would include the amount of
17 ultraviolet radiation. It would include the amount
18 of pred -- or not predation but the amount of
19 organisms that would consume that DNA because
20 they'll use it as a food source. So it would depend 09:12AM
21 on the trophic level. So in a more eutrophic
22 nutrient dense environment, then that DNA would
23 probably be consumed more quickly than in a more
24 allegatory thick environment.

25 Q Can DNA move in the environment after the 09:12AM

1 bacteria that carried it had died, become inactive?

2 A DNA could be transported along with water,
3 yes.

4 Q Could it move in any other way?

5 A It would not be able to be motile on its own. 09:12AM
6 So it would have to be transported by the movement
7 of water or some other matrix.

8 Q Okay. Let's talk briefly about sources of
9 bacteria in the IRW. Since your last deposition,
10 have you studied sources in the IRW, apart from 09:13AM
11 poultry, of any -- of fecal indicator bacteria?

12 A I have not.

13 Q Okay. Has anyone associated with the State's
14 case?

15 A Roger Olsen of CDM has done some work with 09:13AM
16 bacteria in cow manure.

17 Q Okay. Are you familiar with the nature of his
18 work?

19 A I have read his report, yes.

20 Q Have you studied any sources in the IRW, apart 09:13AM
21 from poultry, of E. coli?

22 A No, I have not.

23 Q Okay. Of Enterococci?

24 A No, I have not.

25 Q Campylobacter? 09:13AM

1 **A** No.

2 **Q** Salmonella?

3 **A** No.

4 **Q** Any other bacteria?

5 **A** No. 09:13AM

6 **Q** Have you undertaken yourself to quantify fecal
7 production levels by any animal in the IRW?

8 **A** No, I have not.

9 **Q** Have you undertaken quantification of bacteria
10 loading from any particular source in the IRW? 09:13AM

11 **A** I have not.

12 **Q** Now, you submitted a journal article to the
13 Journal of Applied and Environmental Microbiology;
14 correct?

15 **A** That's correct. 09:14AM

16 **Q** And we were provided a copy of that a couple
17 of days ago. You're on the editorial board of that
18 journal?

19 **A** That's correct.

20 **Q** Okay. Have you discussed your article with 09:14AM
21 any of your colleagues on that board?

22 **A** No, I have not. That wouldn't be -- you don't
23 do that.

24 **Q** Okay. You submitted it on June 11, at least
25 according to the cover E-mail; is that correct? 09:14AM

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1 contamination.

2 Q Okay, but in order for it to be an indicator
3 of poultry fecal contamination, is it necessary that
4 the PCR sequence share the same fate and transport
5 as pathogens from poultry litter?

02:00PM

6 A Can you say that again? I just got to get the
7 first part.

8 Q Sure. In order for it to be an indicator --
9 you've just said it is an --

10 A Indicator of poultry fecal contamination.

02:00PM

11 Q Right, and that fecal contamination you are
12 talking about here is bacteria; correct?

13 A Correct.

14 Q Okay. So in order for the presence of the
15 indicator --

02:00PM

16 A I'm sorry. Let me go back there because we're
17 not only concerned about bacterial fecal
18 contamination from poultry, we're also concerned
19 about nutrient contamination. So we can add
20 nutrients and metals to that list.

02:00PM

21 Q We'll talk about -- let's table the nutrients
22 and the metals for just a second and let's talk
23 about bacteria. In order for it to indicate the
24 presence of bacteria derived from poultry, is it
25 necessary that the PCR -- that the Brevibacterium

02:00PM

1 that you identified share the fate and transport
2 characteristics of other bacteria from poultry
3 litter?

4 **A** It would have to have certain fate and
5 transport characteristics in common. 02:01PM

6 **Q** Okay. If we compare the correlations that we
7 discussed here, so the correlation, let's say,
8 taking Enterococcus, for instance, the relationship
9 between Enterococcus and the sequence in litter as
10 .75 and the relationship between Enterococcus and 02:01PM
11 the biomarker -- the sequence in water is .89, which
12 is different; correct?

13 **A** It's different, but it's certainly within the
14 bounds of what you would expect from regular
15 sampling error. 02:01PM

16 **Q** Okay. How big a difference can you have
17 within the bounds of regular sampling error?

18 **A** In environmental microbiology we're very happy
19 to get correlations of .3 as long as they're
20 statistically significant, even .2 sometimes. So 02:01PM
21 there's a really wide range of what you can get from
22 correlations and still be biologically meaningful.

23 **Q** Okay. So does it surprise you at all then
24 that the correlation that you got between E. coli
25 and the PCR sequence in litter was .39 you told me 02:02PM